NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorders Division
Washington, D.C. 20594

February 4, 2000

Cockpit Voice Recorder

Group Chairman's Factual Report
by Anna W. Cushman

A. ACCIDENT

Location:	Aberdeen, South Dakota
Date:	October 25, 1999
Time:	About 1713 universal coordinated time (UTC)*
Aircraft:	Learjet 35, N47BA
NTSB Number:	DCA00MA005

B. GROUP

Chairman:	Anna W. Cushman Aerospace Engineer (CVR) National Transportation Safety Board
Member:	Robert Agostino Director Flight Operations, Learjet Bombardier Aerospace
Member:	Owen Zahnle Demonstration Pilot, Learjet Bombardier Aerospace
Member:	Dave Chapel Senior Product Safety Specialist AlliedSignal Engines
Member:	Estan Fuller Learjet Captain Sunjet Aviation
Member:	Victoria Anderson Air Safety Investigator Federal Aviation Administration

* All times (hhmm:ss) are expressed in universal coordinated time (UTC), unless otherwise noted.

C. SUMMARY

On October 25, 1999 a Learjet 35, N47BA, departed Orlando, Florida on an IFR flight plan to Dallas, Texas. After departure from Orlando, N47BA was in radio communication with controllers from the Jacksonville air traffic control (ATC). Shortly after 1327 UTC the controller at Jacksonville lost communication with the accident aircraft. N47BA's last communication with ATC was an acknowledgement to climb and maintain 39,000 feet. The aircraft continued on its course until approximately 1713 UTC, at which time it crashed near Aberdeen, South Dakota.

A Universal CVR 30 digital cockpit voice recorder (CVR), serial number 6509, was sent to the audio laboratory of the National Transportation Safety Board on October 28, 1999. The Cockpit Voice Recorder committee convened on November 1, 1999. A transcript was prepared for the 30-minute recording. (See attached.)

D. DETAILS OF INVESTIGATION

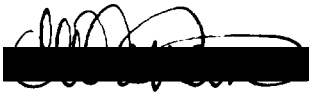
Figure 1: Crash case.

The exterior of the CVR was severely damaged structurally; there was no evidence of heat damage. The inner crash case surrounding the CVR's controller and memory boards was cracked (Figure 1). Upon opening the CVR crash case, the two circuit boards were intact, but showed signs of structural damage. Specifically, there were several components on the controller board that were crushed and a relay unit had become disconnected from the controller board. Also, the ribbon cable attaching the controller and memory boards was crushed. The memory board, however, only showed slight damage in one corner and all memory devices were attached to the board.

The controller and memory board assembly was taken to Universal Avionics for assistance in the data recovery. After assessing the damage to the memory board, it was determined that the integrity of the memory board was intact. A new ribbon cable was installed to join the accident memory board to a new controller board. The diagnostics check on the repaired assembly was normal and the audio data was downloaded for playback.

The recording consisted of two channels of good audio information. Channel one, designated for audio from the Public Announcement (PA) system, did not contain any audio information. Channel two, designated for audio from the co-pilot's station, did not contain any audio information. The remaining two channels, channel three, designated for the pilot's station and channel four for the cockpit area microphone (CAM), contained good audio information. The transcript UTC time reference was established using a correlation to the radar data. The Aircraft Performance Report contains more details regarding this correlation.

The recording began at 1642:40 with a sound similar to N1 drone* and a sound similar to the cabin altitude warning tone. At 1710:41 the sound similar to N1 drone ceased, indicating the possibility that one engine had spooled down. Seventeen seconds later a sound similar to the autopilot disconnect warning was recorded. The sound similar to the stick shaker and overspeed warning were recorded several times through 1711:44. At 1711:44 the background noise increased and continued to increase until the end of the recording. Thirty-three seconds later a sound similar to the overspeed warning resumed and continued until the end of the recording. At 1712:26 the sound similar to the cabin altitude warning tone ceased, followed by the end of the recording at 1712:40. The CVR recording did not contain any audio information identifiable as voice or radio sound sources.



Anna W. Cushman
CVR Group Chairman

* NOTE: *N1 drone*, as referenced within the CVR transcript, can be described as a periodic increase and decrease in engine sound (i.e. the sound of beating due to a phase shift between two superposed sound sources).

Transcript of a Universal CVR30 digital cockpit voice recorder (CVR), s/n 6509, installed on a Learjet 35 (N47BA) which impacted terrain near Aberdeen, South Dakota after air traffic control lost radio communication with the aircraft on October 25, 1999.

LEGEND

CAM	Cockpit area microphone sound source
HOT	Pilot channel sound source
[ ]	Editorial insertion

Note (a): Times (hhmm:ss) are expressed in universal coordinated time (UTC).

Note (b): N1 drone, as referenced within the CVR transcript, can be described as a periodic increase and decrease in engine sound (i.e. the sound of beating due to a phase shift between two superposed sound sources).

UTC SOURCE	CONTENT	UTC SOURCE	CONTENT

[NOTE: All sound sources are intra-cockpit. No aircraft-to-ground sound sources were identified.]

1642:40
Start of Recording
Start of Transcript

1642:40
CAM [sound similar to N1 drone. continues until 1710:41]

1642:40
CAM/HOT [sound similar to cabin altitude warning. continues until 1712:26]

1648:20
CAM [sound of unidentified faint thump]

1710:41
CAM [sound similar to N1 drone ceasing]

1710:56
CAM [sound similar to stick shaker. continues for eleven seconds]

1710:58
CAM/HOT [sound similar to autopilot disconnect]

UTC SOURCE	CONTENT	UTC SOURCE	CONTENT
1711:03 HOT	[sound of unidentified ping, possibly electrical]		
1711:07 CAM	[sound similar to stick shaker ceases]		
1711:09 CAM	[sound of increased background noise]		
1711:11 CAM	[sound similar to stick shaker – momentary]		
1711:14 CAM	[sound of click]		
1711:16 CAM	[sound similar to stick shaker – momentary]		
1711:18 CAM	[sound of unidentified thump]		
1711:19 CAM	[unidentified sounds, possibly associated with unsecured object movement]		
1711:22 HOT	[sound similar to overspeed warning. continues for nine seconds]		

UTC SOURCE	CONTENT	UTC SOURCE	CONTENT
1711:23 CAM	[unidentified sounds, possibly associated with unsecured object movement]		
1711:27 CAM	[sound similar to altitude alert]		
1711:31 HOT	[sound similar to overspeed warning ceases]		
1711:32 CAM	[sound of decreasing background noise]		
1711:38 CAM	[unidentified sounds, possibly associated with unsecured object movement]		
1711:40 CAM	[sound similar to stick shaker. continues for three seconds]		
1711:43 CAM	[sound similar to stick shaker ceases]		
1711:44 CAM	[sound of increased background noise, continues to increase until end of recording]		

UTC SOURCE	CONTENT	UTC SOURCE	CONTENT
1711:45 CAM	[sound similar to stick shaker. continues for seventeen seconds]		
1712:02 CAM	[sound similar to stick shaker ceases]		
1712:17 CAM/HOT	[sound similar to overspeed warning, continues until end of recording]		
1712:26 HOT	[sound similar to cabin altitude warning ceases]		

1712:40
End of Transcript
End of Recording